

EVIDENCE FOR BIVOLTINE POPULATIONS OF THE MEDITERRANEAN BLACK  
SCALE *SAISSETIA OLEAE* (OLIVIER) ON CITRUS IN ISRAEL (1)

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A B S T R A C T

Bivoltine populations of the Mediterranean black scale, *Saissetia oleae* (Olivier), were sampled for the first time on citrus in Israel. Two theories are proposed to account for the scale's change from univoltinism to bivoltinism.

INTRODUCTION

The Mediterranean black scale *Saissetia oleae* (Olivier) is a major pest of citrus in Israel. Damage is due mainly to "sooty mold" fungi which develop on the large quantities of honeydew excreted onto leaves, branches and fruits. The black scale may also sometimes severely affect olives. Although Bodenheimer (1951) and Peleg (1965) reported that *S. oleae* has only one annual generation on citrus in Israel, the scale appeared to be bivoltine in certain citrus groves recently examined in the Coastal Plain. Observations made during the period 1970- 1975 on the life cycle of this pest are reported herein.

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## METHODS

Samples were collected monthly from orange trees in three citrus groves along the Coastal Plain: at Bazra during September 1970 - August 1971, and at Givat Hen and Herut during May 1973 - May 1975. Periodic samplings were made of Marsh grapefruit at Bet Herut (in November 1970) and Tel Yizhaq (January 1971). Each sample usually consisted of 500 to 1000 (when available) live scales, obtained from the leaves and woody parts of 40-50 randomly-collected twigs, each 30-40 cm in length. The scales were examined and recorded according to stage, females being further separated into young, "rubber" and ovipositing scales (Argyriou, 1963; Ebeling, 1959).

## RESULTS

At Bazra (Fig. 1) the scale had only a single annual generation, oviposition taking place mainly during April through July; very little oviposition occurred during winter.

In the orange grove at Givat Hen and Herut (Figs. 2, 3), ovipositing scales appeared in early summer and autumn. Although the percent of ovipositing scales during autumn was low, two annual, partly overlapping generations were evident in the two groves sampled.

Two single samples of grapefruit leaves and twigs obtained during the winter months were found to be infested by relatively large numbers of ovipositing females (Table 1). Further observations at Bet Herut showed that ovipositing females were present there as early as October and as late as February.

## DISCUSSION

Peleg (1965) stated that *S. oleae* raises a single annual generation on citrus and on unirrigated olives in Israel. Univoltine development of this pest on citrus was also reported by Ebeling (1959) from California, by Balachowsky and Mesnil (1935) from France, by Jarraya (1974) from Tunisia, and by Tuncyüreck (1975) from western Turkey.

The slow summer development of *S. oleae* suggested to Bodenheimer (1951) that the scale's young were in diapause during that period. Peleg (1965) found that in summer citrus-infesting immatures continued to develop, albeit at a slower rate. No evidence for summer diapause was found in the present study; *S. oleae* continued to develop and produced a second generation during autumn and early winter. Ebeling (1959) has also reported on the occurrence of two annual generations of *S. oleae* on citrus in California in certain regions close to the coast.

Two theories may be proposed to explain the apparent shift from a univoltine to a bivoltine cycle in *S. oleae*: (i) This species has several times been suspected of consisting of several biologically different "strains" (Bartlett, 1960; De Lotto, 1971), and the evidence presented herein may in fact relate to two different species. (Mr. G. De Lotto of Pretoria, South Africa, has kindly examined some of our samples and determined them to be morphologically typical *Saissetia oleae* (Olivier).) (ii) This change in life cycles may be due to the adaptation of *S. oleae* to changing citriculture practices in Israel. The thinning of groves and other recent practices are no doubt bringing about subtle changes in the ecology of citrus groves. Improved plant nutrition may likewise accelerate the scale's life processes. These changes may favor the appearance of bivoltine populations - a phenomenon known from irrigated olives of Israel (Peleg, 1965). The data obtained at Bazra (Fig. 1) suggest that at this locality we actually observed an incipient bivoltine population. Should this second theory prove to be correct, all local populations will probably become bivoltine in the near future, which may increase the pest status of *S. oleae*.

The introduction of parasitoids of *S. oleae* from Africa is now in progress. These natural enemies attack mainly the third nymphal instar of the scale and its non-ovipositing females. Hence it is possible that once *S. oleae* turns bivoltine, more scale stages suitable for parasitization will be available almost the whole year around (Figs. 2, 3). The shift to bivoltinism may thus in the long run, turn out to be a blessing in disguise.

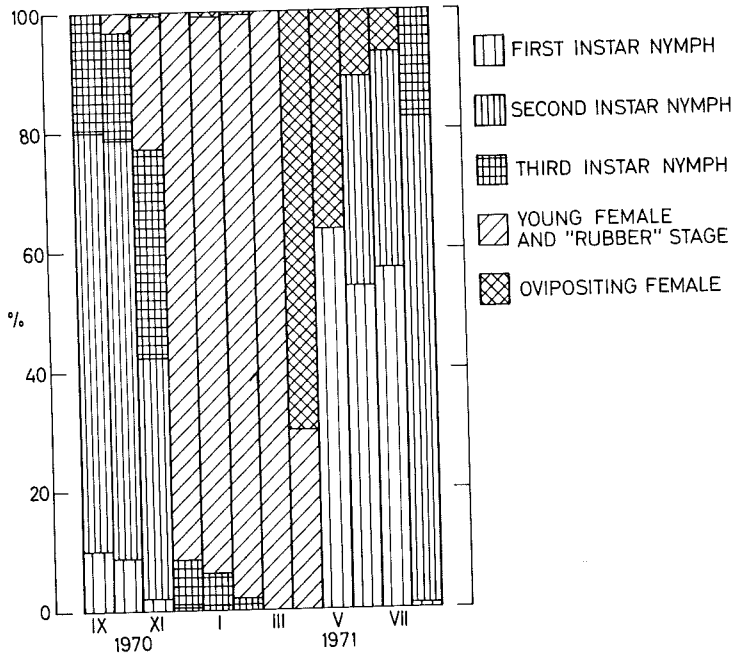
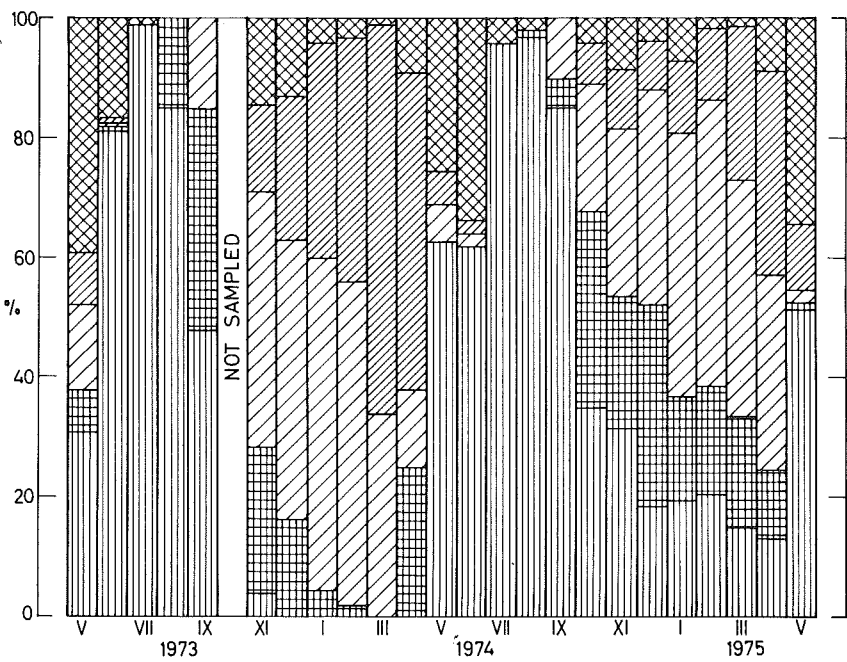
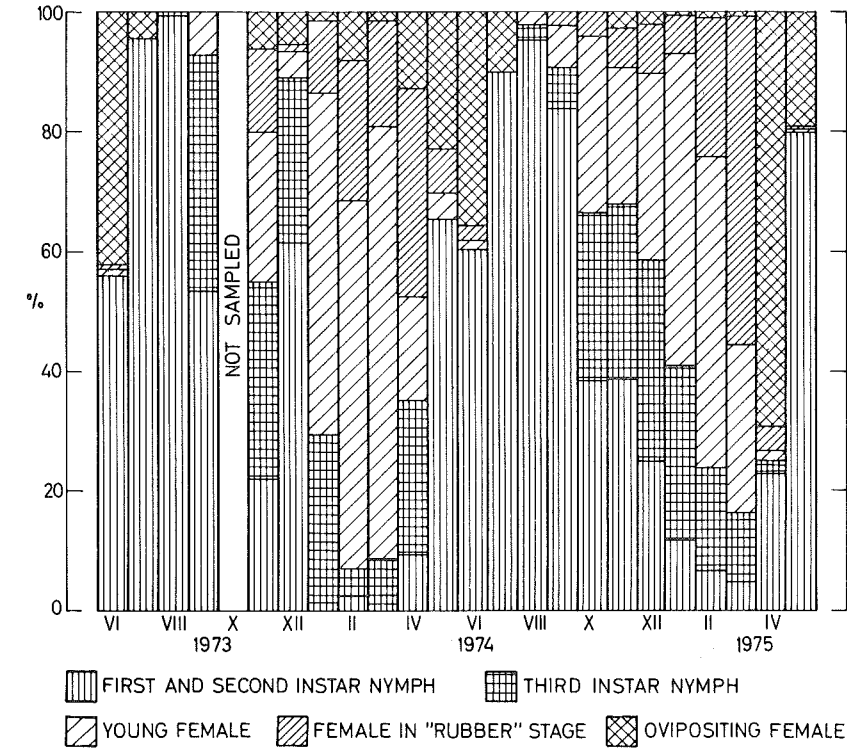


Fig. 1. Occurrence of various *Saissetia oleae* instars on oranges in the Bazra grove.

TABLE 1. Composition (in %) of live *S. oleae* populations on leaves and twigs of Marsh grapefruit in groves at Bet Herut and Tel Yizhaq.

Grove	Date	Leaves						Twigs					
		N	First instar nymph	Second instar nymph	Third instar nymph	Young female and 'rubber' stage	Ovipositing female	N	First instar nymph	Second instar nymph	Third instar nymph	Young female and 'rubber' stage	Ovipositing female
Bet Herut	November 1970	184	13.1	43.4	21.7	10.8	10.8	317	15.8	33.1	23.9	14.5	12.6
Tel Yizhaq	January 1972	285	7.0	3.0	1.0	44.0	45.0	90	6.5	3.5	0	67.0	23.0



2. Figs. 2 and 3. Occurrence of various *Saissetia oleae* instars on oranges in the Givat Hen (Fig. 2, above) and Herut (Fig. 3, below) groves.

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